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Instrumental music: Clara Louise Anderson, *Instrumental Characteristic Rhythm*, Parts I and II; A. D. Scammel, *Musical Rhythms for Piano*.

Rhythm: Marching, simple skipping, running, tiptoe running, sunbeams, clouds, butterfly and bird movements.

NATURAL SCIENCE.

WILBUR S. JACKMAN, ALICE P. NORTON, IRA B. MEYERS.

IN order to meet as fully as possible the needs of those who desire work in nature study, the subject will be presented in three closely related courses. Course I deals with the subject in its general aspects, and Courses II and III deal with special topics in considerable detail. During the first three weeks, Course I will be open only to those who enter for the first half of the term. During the last three weeks it will be open (1) to those who enter at that time and (2) to those who are taking either Course II or Course III, and who may desire a somewhat broader survey of the field.

The primary- and grammar-grade teachers who elect Course I will be assigned to separate sections, and the work will be adapted to each. The sections will be divided into groups for convenience, and each group will be assigned according to the choice of the individual to definite work upon which each student will be expected to make reports as often as necessary. The subjects given to the groups will be selected from the subjoined syllabus of topics. Each group will report to the entire class, so that the mutual relations of the different lines of study will appear. The topics for discussion will be assigned to different groups for presentation, through which the pedagogic aspects of the subject will be considered.

COURSE I. PEDAGOGICS OF NATURE STUDY.

WILBUR S. JACKMAN.

I. *Field work as a basis for nature study*.—(1) The landscape as a moving picture; its daily, seasonal, and more general aspects; those related to the work of man. (2) The chapters in landscape history; procession of plants and animals; their interrelations; plants and animals as constructive and

destructive agents; buried history of the landscape. (3) The landscape as an organized whole; the primary and secondary influences. (4) Human development and history as related to the landscape; food; drainage, slopes, springs; fuel; shelter; exchange; occupations; reactive effect of environment; values as determined by the landscape features.

PRACTICAL WORK: The students will be asked to describe and interpret the landscape with which they are most familiar. Different areas near the school will be used as a basis for further study.

DISCUSSION: *What is observation? Its function? Conditions?*

II. *History of the year in color.*—Scientific significance of color. Observation of children as judged by their paintings; color, form, perspective; individuality of pupils.

PRACTICAL WORK: Students will be required to make a sketch of the landscape in color. (Water-colors, brushes, and painting paper must be provided by the student for this lesson.)

DISCUSSION: The *simple* in nature contrasted with the *complex*; the *near* with the *remote*; the *vast* with the *small*; the *regular* with the *irregular*.

III. *Landscape activities: the plants.*—(1) Colonization of plants; relation to physical features; water areas; shore and marsh areas; dry alluvial areas; upland areas; rock and sand areas; slopes. (2) Colonies of plants as affected by the seasons; as affected by each other; competition and boundaries; migration; interdependence. (3) Interrelations of individuals in a colony.

PRACTICAL WORK: Field study of colonies in the vicinity.

DISCUSSION: *Relation of reading to observation.*

IV. *The problem of living: plant devices.*—(1) Problem stated; the plant essentially active. (2) From the isolated seed to the all-related plant; how it establishes relations to heat, light, and moisture; space and time relations.

PRACTICAL WORK: Students will be required to work out various relations of plants from the form of specimens selected from the field.

DISCUSSION: *The tests of good reading matter. Students required to make selections.*

V. *Landscape activities: animals.*—(1) Animal colonization related to physical aspects; in the soil and water; on the shores; in rock ledges lowlands, uplands, woods, meadows. (2) Various aspects of trees, of water areas, of the atmosphere, inviting colonization. (3) Interrelations of colonies; boundaries; migration; extinction; mutual support.

PRACTICAL WORK: Field and museum study of specimens. Modes of preserving colonies for study.

DISCUSSION: *How children may develop reading lessons of interest to the whole school.*

VI. *The problem of living: animal functions.*—(1) Functions of the animal body: nutrition, excretion, energy, reproduction. (2) Interrelations:

offense, defense, co-operation. (3) Relations to environment: form and covering.

PRACTICAL WORK: Study of the constituents of tissues; of food-stuffs. Structure studied by means of models and dissections.

DISCUSSION: *How should writing be used in connection with the lesson?*

VII. *The fate of living things: change.*—(1) Life period; duration; accidents; natural termination. (2) Disintegration of tissues; redistribution of matter under different conditions. (3) Fossilization; conditions contrasted with those causing decay.

PRACTICAL WORK: Study of a fossil; interpretation of its history.

DISCUSSION: *Function of written work.*

VIII. *The fate of living things: change.*—(1) Idea of change substituted for the primitive idea of destruction. (2) Decay as related to reorganization.

PRACTICAL WORK: Determination of gross constituents of various parts of plants and animals.

DISCUSSION: *What is the relation of observation to imagination?*

IX. *Inorganic nature: change.*—(1) Agents of organization: living things; water; the atmosphere; rock changes; solution, filtration, deposition. (2) Agents of disintegration: living things; heat, water, air, etc.

PRACTICAL WORK: Study of museum specimens of rocks. Field study.

DISCUSSION: *Importance of preserving pupils' work as a record.*

X. *Inorganic nature: force.*—(1) Study of heat in sunshine; distribution. (2) Heat as energy in the living form.

PRACTICAL WORK: Measurements showing the variation of heat distribution at different hours of the day and in different seasons.

DISCUSSION: *The misconceptions of nature acquired by the child through direct observation.*

XI. *Inorganic nature: life-conditions.*—(1) Province of meteorology; weather maps; their exceptional value. (2) Sources of moisture in the United States; storm paths; development of great climatic pictures. Use of Weather Bureau statistics.

PRACTICAL WORK: Use of meteorological instruments. Keeping of records.

DISCUSSION: *Myth and nature study.*

XII. *Inorganic nature: life-conditions. Water.*—(1) Atmospheric vapor. The psychrometer. (2) Quantity of water in a given rainfall; in a given depth of soil. (3) Evaporation: from the soil; from free surface of water. (4) Transpiration by plants.

PRACTICAL WORK: Use of instruments; measurements and calculation of results.

DISCUSSION: *The function of number work in nature study.*

XIII. *Inorganic nature: life-conditions. Light.*—Physiology of seeing;

sources of light ; radiation and reflection ; visibility of objects. (2) Invisibility of light ; phenomena of color.

PRACTICAL WORK : Experiments showing effect of light upon plants ; formation of images by reflection and refraction.

DISCUSSION : *The place of experiment in nature study.*

XIV. *The direction and transfer of energy.*—(1) The function of a machine ; the human body as a machine. Relation of efficiency to form and proportion. (2) Economy in structure.

PRACTICAL WORK : Calculation of work done through machines. Various strength tests of materials used in building.

DISCUSSION : *The place of manual training in school work.*

XV. *Nature study in the development of moral character.*—(1) Man's various notions regarding the universe. The geocentric idea—the Ptolemaic theory; the heliocentric idea—the Copernican theory. (2) Man's notions regarding the world of life ; anthropocentric idea—theory of special creation ; biocentric idea—theory of evolution. (3) Early prejudices ; different conceptions of character depending upon notions regarding the origin of things. (4) Nature and the formal or external aspects of character. Does nature study sanction or condemn "ape and tiger" methods in society. Development of motive. (5) Nature study and the will. Evolution of good will.

DISCUSSION : *How can school work in general be made most effective in character-building?*

COURSE II. CHEMISTRY.

ALICE P. NORTON.

THE work here given differs from the ordinary course in general chemistry chiefly in the method of approach. For the sake of relating the science more closely to the life of the pupils, and of giving reality to chemical phenomena, the work is begun with the study of common objects of daily experience. Leaves and fruits have been selected for investigation, and the elements studied will be considered in relation to the life of the plant, as well as from the chemical standpoint. The work will be embraced under the following heads :

I. *Investigation of the composition of different leaves and fruits* as to the amount of water, of combustible material, and of ash contained in them. A number of different kinds both of leaves and fruits will be used, that their comparative composition may be determined.

II. *The study of the ultimate composition of the substances found, and of the most important elements present.*—(1) Water. Properties, solvent power

boiling and freezing points; composition, determined by electrolysis. (2) Hydrogen. Preparation from zinc and acid; synthesis of water by burning of hydrogen. (3) Burning of various substances in air: sulphur, magnesium, iron, zinc. Determination of gain or loss of weight by igniting five grams of zinc dust or iron filings, weighed before and after heating. Preparation of oxygen from red oxide of mercury, and from potassium chlorate and manganese dioxide. (4) Nitrogen, obtained by the action of moist iron filings on an inclosed volume of air. Composition of air. (5) Carbon, burned in oxygen, and the product tested. Other sources of carbon dioxide; use in vegetable life. (6) Sulphur and its oxides. Formation of sulphuric acid. (7) Preparation of hydrochloric acid from sulphuric acid and salt; study of acids, bases, salts. (8) Chlorine group. Quantitative determination of chlorine in table salt. (9) Metallic elements most commonly found in leaf and fruit: sodium, potassium, calcium, etc.

III. *Laws of chemical change and combination.*—As the experiments suggest it, physical and chemical change, the atomic theory in its simplest form, valence, the laws of definite and multiple proportions, and such other theory as seems necessary, will be discussed.

IV. *Pedagogy.*—Place of chemistry in the work of the elementary and of the secondary school. When do children ask questions which can be answered only by chemical experiment? Value to the teacher in other work. Method of presentation.

COURSE III. ELEMENTARY FIELD WORK.

IRA B. MEYERS.

EXPLANATORY: The following courses are a study of the occurrence, distribution, and interrelation of the organic and inorganic forms of a topographic area.

The course in elementary biology is a study of an area with special reference to the interrelation of its life-forms.

The museum course is a study of the materials found in an area with special reference to the collecting and preparation of this material for class study.

The courses are distinct in the prominence given these two phases.

The work of both courses is based on a series of excursions to typical localities in the vicinity of the Kosminski School.

FIELD STUDY (BIOLOGY).

“The life of any region may be considered as an association bound together by the fact that all the forms are adapted to living in the area.”

The topography of the area determines directly or indirectly the occurrence and distribution of the life-forms included in it.

The varied conditions of temperature, moisture, soil, light, slope, as well as the living forms themselves, present as many conditions for living, and the life-forms are usually as varied as the conditions for living.

The aim of the field work is to observe conditions under which life exists and to note the influence of constant and varying factors in the area upon its occurrence, distribution, characteristics, and life-history.

General outline.—Physiographic features: Lake, beach, sand (dune) and clay (glacial drift) bluffs and uplands. Swamps and lagoons, rock outcrops, lowland and upland meadows, with usual ridge and depressions.

A. PLANT LIFE.

I. OCCURRENCE AND DISTRIBUTION OF PLANTS.

1. *Observation and identification of plants found in the various areas.*—(a) Beach plants—old beach, recent beach. (b) Plants on sand (dune) areas, on clay (drift) areas: (1) recently disturbed areas; (2) old areas. (c) Swamp areas—plants within the water border; plants outside of water border, but within marshy area; plants on margin of marsh extending to low meadow land. (d) Plants common to prairie (beach) ridges, to depressions.

QUESTIONS: What plants seem generally distributed throughout these areas? What plants are confined to certain particular areas? What factors seem to have the greatest influence upon plant distribution in this region? What are the striking differences in plants of these various areas? Do these structural differences determine to any extent the position of the plants in the area?

II. CONDITIONS INFLUENCING THE PLANT LIFE OF A REGION.

1. *Soil conditions.*—(a) Nature of soils in the various visited areas (composition or kind). (b) Chemical nature of each soil. (c) Physical nature of the soil. (d) Heat and moisture capacity and retaining qualities of these soils. (e) Root penetration.

QUESTIONS: In what ways do the soils of these areas seem to influence plant growth and distribution? Are the variations due to soil influence the result of the physical or chemical nature of the soil? Does the nature of these soils seem to affect plant structure? What particular plant structure is most closely related to the soil?

2. *Temperature conditions.*—(The influence of temperature upon plant life should be observed during spring and fall, and this phase of study will depend upon previous observations.) Influence of present (July) temperature

conditions upon plant life. Plant structure and adaptations related to temperature.

3. *Light conditions*.—(a) Variable light conditions of the plants of the area. (b) Parts of plants most intimately related to light. (c) Structures and adaptations which enable plants to grow under various light conditions.

QUESTIONS: What variations in plant growth, color, form, or distribution are caused by their light relations? How do plants avoid the shade of surrounding vegetation? How do plants avoid the shade of their own foliage?

4. *Moisture conditions*.—(a) Variation in moisture conditions in the several areas. (b) Variations in plant structure as caused by moisture conditions. (c) Plant groups or societies as related to moisture conditions.

QUESTIONS: What variation in structure is noticeable in plants living in extreme moisture conditions (pond to dune)? What parts of plants are most closely related to moisture? Do plants have any control of their water supply?

B. ANIMAL LIFE.

GENERAL OBSERVATIONS: Forms found in each physiographical feature: Dominant forms. Occasional forms.

1. *Range*.—(a) Forms unrestricted in their range. (b) Forms restricted to a particular part of the area. (c) Forms present because of a particular physiographic feature—permanent residents. (d) Forms attracted by seasonal food—temporary residents.

2. *Movement*.—Demands for movement; range; factors influencing movement. Organs of locomotion. (a) As adaptations to different media—land, air, water. (b) As affected by some peculiar aspect of the same medium. (c) As affected by peculiarity of habit.

3. *Food*.—(a) Condition or nature of food—liquid or solid. (b) Character of food—vegetable, animal, mixed. Food, vegetable: locating food; kind of plant; part of plant; effect of injury upon plant; plants attempt to resist undue injury; length of time food is available and relation to life of animal. Food, animal: method of locating and capturing food.

4. *Protection*.—(a) Adaptations which enable individuals to maintain their position among these various forms. (1) Life-forms living in areas inaccessible to other forms. (2) Specially constructed homes or shields. (3) Special protective organs. (4) Secretions. (5) Cunning and swiftness. (6) Color protection. Without visible means of protection. (b) Adaptations enabling individuals to resist seasonal changes.

5. *Homes*.—(a) Living isolated in pairs, in colonies. (b) Living in constructed homes. (c) Depending upon accidental shelter of holes, crevices, etc. (d) Changing growing vegetation into homes—galls. (e) Songs, calls, etc.; purpose, methods of producing sound.

REFERENCES: Salisbury and Alden, *The Geography of Chicago and its Environs*; Cowles, *The Plant Societies of Chicago and Vicinity*; Jordan, *Animal Life*; Coulter, *Plant Relations*; Comstock, *Insect Life*; Chapman, *Bird Life*.

MUSEUM.

EXPLANATORY: In the main the nature of the material in a school museum would be determined by the course of study or class work of the school. The mass of the material should be arranged in related groups or series. These series should be such as would form centers for study. The greater part of the material should be selected and prepared by pupils from materials within the range of environment of the school, and should aim to illustrate associated relations of form, structure, color, etc.

The collecting and arrangement of this material are a definite study which finds expression or meaning in its arrangement. The educational value of any material depends upon its appeal to the observer; whatever appeals to us we see—the rest of the natural world passes by unobserved.

All materials exhibit associated relations of force or function, but these relationships are frequently so distributed through time and space as to remain isolated and obscure, *e. g.*, the various phenomena of erosion, transportation, and deposition of rock material as related to soils and sedimentary rock.

SUGGESTIVE SERIES FOR MUSEUM STUDY.

1. *Minerals*.—(a) Common rock-forming minerals (twenty-five to thirty specimens); their properties and resulting effect upon the rocks composed of them. (b) Series of common rocks (fifteen or twenty) and their varieties; their properties as related to erosion, topography, and industry. (c) Effect of various erosive agencies on (b), as illustrated by collected rocks. (d) Various stages of decay in rocks—final products. (e) Effect of pressure on rocks as exhibited in rock formations. (f) Mineral biographies: (CaCO₃) as bone, shell, coral, coquina, various limestones, crystals, marble. (g) Mineral industries—clay products and processes, etc.

2. *Plant life*.—(a) Plant structure as exhibited in woods, etc. (b) Plant structure as adaptation to environment. (c) Plant structure as adaptation to distribution. (d) Plant structure as related to industry. (e) Elements and compounds entering into plant body, etc.

3. *Animal life*.—(a) Insects—protective adaptations, homes, food materials, changes of plant forms, metamorphosis, etc. (b) Other forms—structural modifications in coverings, dentition, and mouth parts; organs of locomotion; animal products; elements and compounds (proportion) entering into composition of the animal body. (c) Special group: an area as a center for life.

4. *Miscellaneous*.—(a) Various commercial products of a natural product: coal—tars, oils, drugs, colors, etc. (b) Historic aspect in the development of lighting. (c) Industrial processes—manufacture of cotton goods, silk, etc.